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UNITED STATES NAVAL OBSERVATORY

CIRCULAR NO. 123

U. S. Naval Observatory, Washington, D. C. 20390

February 12, 1969

Annular Solar Eclipse of 11 September 1969

by

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GENERAL INFORMATION

The path of the annular phase of the solar eclipse of 11 September 1969 touches the earth at sunrise in the North Pacific Ocean when the duration is $2^m 59^s.5$ and the width of path is 109 miles, and travels in a southeasterly direction passing west of North America. Central eclipse occurs at $19^h 44^m.5$ U. T. at latitude $+19^\circ 03'.4$, and longitude $+116^\circ 59'.1$, when the duration is $3^m 07^s.6$ and the width of path is 69 miles.

The path continues in a southeasterly direction crossing the coast of Peru south of Lima between latitudes $-12^\circ 30'$ and $-14^\circ 10'$ at $21^h 44^m$ U. T., and continues across Peru and Bolivia. The path of the eclipse leaves the earth at sunset near the Bolivia-Brazil border when the duration is $2^m 54^s.5$ and the width of path is 105 miles.

Partial phases of the eclipse are visible over the extreme northeastern part of Asia, the eastern part of the Pacific Ocean, North America except the northeastern part, and most of South America.

The predictions in this *Circular* are derived from the basic data given in the American Ephemeris and Nautical Almanac for the Year 1969. The arguments are in Universal Time, and the longitudes west of Greenwich are positive. The position of the sun is referred to the equinox of FK4 by applying a correction of $1^s.34$. The value of ΔT , used in the computations, is 38.3 seconds.

The value of 0.2724807 for k has been used in these computations. In the local circumstances, the angle P is the position angle of the point of contact, measured eastward from the north point of the solar limb, and the angle V is the position angle of the point of contact, measured eastward from the vertical circle. The duration tabulated in the local circumstances is derived from the second and third contacts.

GENERAL INFORMATION (Continued)

The circumstances of the eclipse are plotted by the Nautical Almanac Office on portions of the Air Navigation Charts Series V30, and the Operations Control Center Plotting/Display Charts 17,000 Series of the U. S. Naval Oceanographic Office.

This *Circular* contains the following information: The Eclipse Map from the American Ephemeris and Nautical Almanac, p. 4; The Path of the Annular Phase, p. 5; The Central Line, Duration and Width of Path at 10,000 feet, 20,000 feet, 30,000 feet, 40,000 feet, pp. 6,7; The Central Line, Duration and Width of Path at 80 km, 100 km, 200 km, 300 km, pp. 8,9; Local Circumstances for Points on the Central Line, pp. 10,11; Local Circumstances for Geographic Locations for both Annular and Partial Phase, pp. 12,13; Maps of Portions of the Path, and of the Path, pp. 14 through 17.

It is requested that precise observations of contact times of this eclipse, as well as the coordinates of the place of observation, be reported to

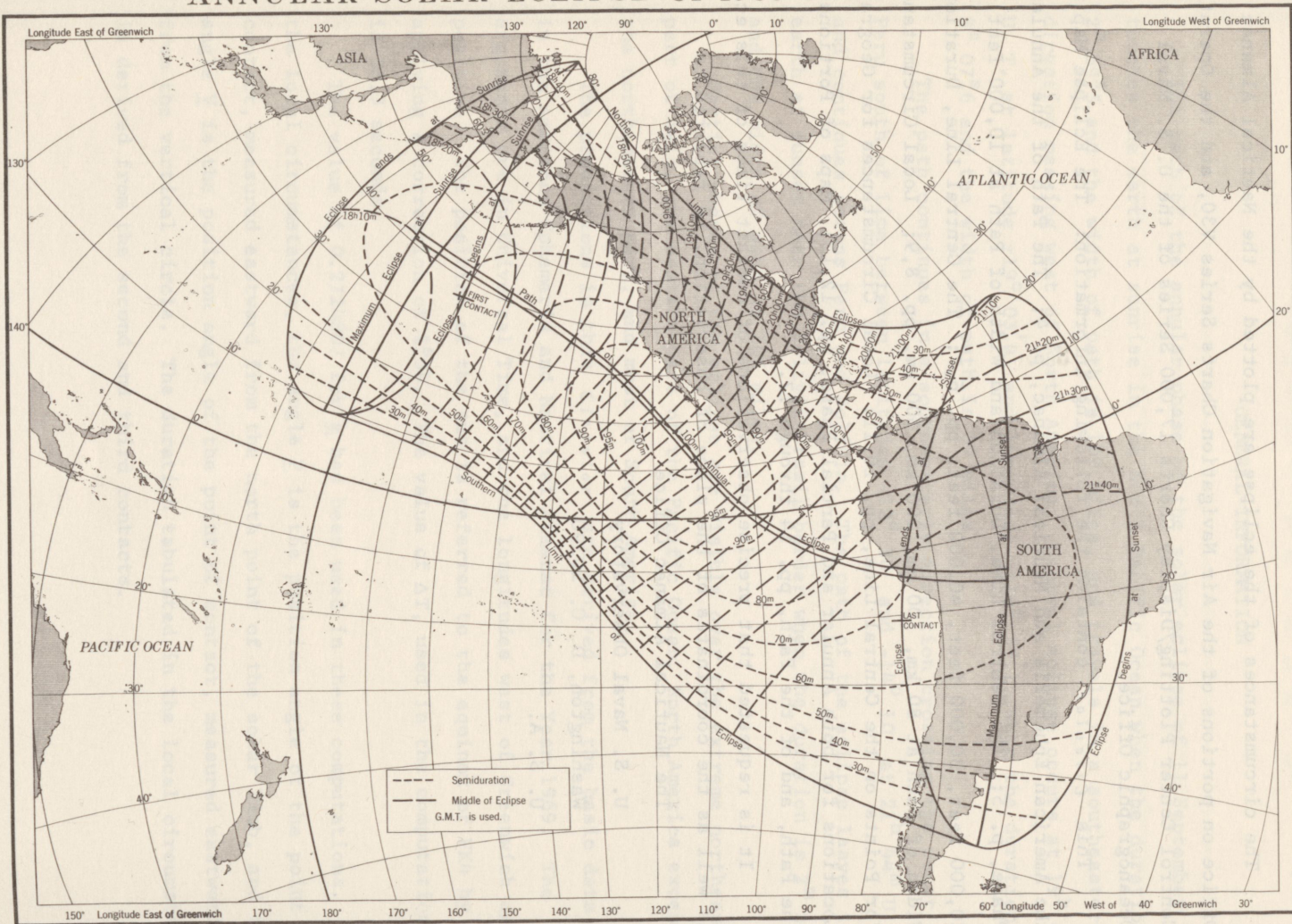
The Nautical Almanac Office

U. S. Naval Observatory

Washington, D. C. 20390

U. S. A.

ANNULAR SOLAR ECLIPSE OF 1969 SEPTEMBER 11



PATH OF THE ANNULAR PHASE

Universal Time	Northern Limit		Central Line		Southern Limit	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
Limit	+42 19	-173 19	+41 32	-173 32	+40 46	-173 44
18 07	.. ..	.. ..	41 51.8	-178 55.0	41 12.2	+178 29.8
08	42 43.6	+177 02.3	41 59.9	+175 22.5	41 16.1	174 04.8
09	42 42.7	172 53.7	41 57.9	171 49.7	41 13.5	170 56.3
10	42 37.0	169 49.8	41 52.2	169 03.1	41 07.9	168 23.1
18 11	+42 29.0	+167 18.4	+41 44.5	+166 42.6	+41 00.5	+166 11.5
13	42 09.0	163 11.4	41 25.4	162 49.3	40 42.4	162 30.0
15	41 45.8	159 49.9	41 03.3	159 36.4	40 21.3	159 24.9
18 20	+40 40.6	+153 16.5	+40 00.7	+153 15.8	+39 21.2	+153 15.9
25	39 30.0	148 14.8	38 52.5	148 21.3	38 15.3	148 28.3
30	38 16.6	144 08.5	37 41.2	144 19.7	37 06.1	144 31.2
35	37 01.6	140 40.4	36 28.2	140 54.9	35 54.9	141 09.5
18 40	+35 45.7	+137 40.4	+35 14.1	+137 57.3	+34 42.5	+138 14.2
45	34 29.4	135 02.3	33 59.3	135 20.9	33 29.3	135 39.4
50	33 12.8	132 41.5	32 44.1	133 01.4	32 15.6	133 21.2
55	31 56.1	130 34.9	31 28.8	130 55.8	31 01.5	131 16.5
19 00	+30 39.4	+128 40.0	+30 13.3	+129 01.6	+29 47.2	+129 23.1
05	29 22.9	126 54.9	28 57.8	127 17.1	28 32.7	127 39.1
10	28 06.4	125 18.1	27 42.3	125 40.7	27 18.2	126 03.2
15	26 50.1	123 48.3	26 26.8	124 11.2	26 03.6	124 34.1
20	25 33.9	122 24.5	25 11.5	122 47.7	24 49.1	123 10.8
25	24 17.9	121 05.9	23 56.2	121 29.3	23 34.5	121 52.6
19 30	+23 02.0	+119 51.5	+22 40.9	+120 15.1	+22 19.8	+120 38.6
35	21 46.3	118 40.9	21 25.7	119 04.6	21 05.2	119 28.2
40	20 30.6	117 33.3	20 10.5	117 57.1	19 50.5	118 20.9
45	19 15.1	116 28.3	18 55.4	116 52.2	18 35.8	117 16.1
50	17 59.5	115 25.3	17 40.2	115 49.3	17 21.0	116 13.3
55	16 44.0	114 23.8	16 25.0	114 48.0	16 06.1	115 12.1
20 00	+15 28.5	+113 23.6	+15 09.7	+113 47.9	+14 51.1	+114 12.1
05	14 13.0	112 24.0	13 54.4	112 48.5	13 35.9	113 12.9
10	12 57.4	111 24.7	12 38.9	111 49.4	12 20.5	112 13.9
15	11 41.6	110 25.4	11 23.2	110 50.2	11 04.9	111 15.0
20	10 25.7	109 25.5	10 07.3	109 50.6	9 49.0	110 15.5
25	9 09.6	108 24.6	8 51.1	108 50.0	8 32.8	109 15.1
20 30	+ 7 53.2	+107 22.4	+ 7 34.6	+107 48.0	+ 7 16.2	+108 13.4
35	6 36.5	106 18.2	6 17.8	106 44.1	5 59.2	107 09.9
40	5 19.5	105 11.5	5 00.5	105 37.8	4 41.7	106 03.9
45	4 02.0	104 01.7	3 42.7	104 28.4	3 23.7	104 55.0
50	2 44.0	102 48.2	2 24.4	103 15.3	2 05.0	103 42.3
55	1 25.4	101 30.0	+ 1 05.4	101 57.7	+ 0 45.6	102 25.2
21 00	+ 0 06.1	+100 06.2	- 0 14.4	+100 34.5	- 0 34.7	+101 02.6
05	- 1 14.1	98 35.6	1 35.1	99 04.6	1 55.9	99 33.4
10	2 35.2	96 56.6	2 56.9	97 26.4	3 18.3	97 56.0
15	3 57.4	95 07.3	4 19.9	95 38.0	4 42.0	96 08.5
20	5 21.1	93 04.8	5 44.4	93 36.7	6 07.4	94 08.3
25	6 46.5	90 45.2	7 10.7	91 18.6	7 34.7	91 51.7
21 30	- 8 14.1	+ 88 02.6	- 8 39.4	+ 88 38.0	- 9 04.5	+ 89 13.0
35	9 44.7	84 46.9	10 11.3	85 25.1	10 37.6	86 02.8
40	11 19.8	80 38.1	11 48.0	81 21.1	12 15.7	82 03.3
21 42	-11 59.8	+ 78 34.5	-12 28.6	+ 79 20.7	-12 57.0	+ 80 05.7
44	12 41.6	76 08.5	13 11.1	76 59.5	13 40.1	77 48.7
46	13 26.1	73 06.6	13 56.2	74 05.7	14 25.9	75 02.0
21 48	-14 16.1	+ 68 50.8	-14 46.4	+ 70 09.6	-15 16.4	+ 71 21.2
49	14 46.7	65 26.5	15 15.8	67 16.8	15 45.2	68 48.3
50	.. ..	.. ..	15 59.8	61 14.6	16 21.1	64 51.1
Limit	-15 23	+ 59 30	-16 08	+ 59 39	-16 53	+ 59 49

ANNULAR SOLAR ECLIPSE OF 11 SEPTEMBER 1969

CENTRAL LINE OF ANNULAR ECLIPSE

Universal Time	10,000 Feet				20,000 Feet				30,000 Feet				40,000 Feet			
	h	m	Latitude °	Longitude °	Latitude °	Longitude °	Latitude °	Longitude °	Latitude °	Longitude °	Latitude °	Longitude °	Latitude °	Longitude °	Latitude °	Longitude °
18 07			+41 52.6	-179 24.5	+41 53.3	-179 51.7	+41 53.8	+179 43.0	+41 54.2	+179 19.1			+41 54.2	+179 19.1		
08			41 59.6	+175 08.0	41 59.2	+174 53.8	41 58.9	174 39.8	41 58.5	174 26.1			41 58.5	174 26.1		
09			41 57.3	171 38.9	41 56.6	171 28.1	41 56.0	171 17.5	41 55.4	171 07.0			41 55.4	171 07.0		
10			41 51.5	168 54.1	41 50.7	168 45.2	41 50.0	168 36.4	41 49.2	168 27.6			41 49.2	168 27.6		
18 11			+41 43.7	+166 34.8	+41 42.9	+166 27.1	+41 42.0	+166 19.4	+41 41.2	+166 11.8			+41 41.2	+166 11.8		
13			41 24.5	162 43.0	41 23.6	162 36.8	41 22.7	162 30.6	41 21.7	162 24.4			41 21.7	162 24.4		
15			41 02.3	159 31.1	41 01.4	159 25.8	41 00.4	159 20.5	40 59.4	159 15.3			40 59.4	159 15.3		
18 20			+39 59.7	+153 11.9	+39 58.7	+153 08.0	+39 57.7	+153 04.1	+39 56.7	+153 00.3			+39 56.7	+153 00.3		
25			38 51.5	148 18.2	38 50.5	148 15.2	38 49.4	148 12.1	38 48.4	148 09.1			38 48.4	148 09.1		
30			37 40.2	144 17.2	37 39.2	144 14.8	37 38.2	144 12.3	37 37.2	144 09.8			37 37.2	144 09.8		
35			36 27.2	140 52.8	36 26.3	140 50.7	36 25.3	140 48.7	36 24.3	140 46.6			36 24.3	140 46.6		
18 40			+35 13.1	+137 55.5	+35 12.2	+137 53.8	+35 11.3	+137 52.1	+35 10.3	+137 50.4			+35 10.3	+137 50.4		
45			33 58.4	135 19.4	33 57.5	135 17.9	33 56.6	135 16.5	33 55.7	135 15.0			33 55.7	135 15.0		
50			32 43.3	133 00.2	32 42.4	132 58.9	32 41.6	132 57.7	32 40.7	132 56.4			32 40.7	132 56.4		
55			31 27.9	130 54.7	31 27.1	130 53.6	31 26.3	130 52.6	31 25.5	130 51.5			31 25.5	130 51.5		
19 00			+30 12.5	+129 00.7	+30 11.7	+128 59.8	+30 11.0	+128 58.9	+30 10.2	+128 58.0			+30 10.2	+128 58.0		
05			28 57.0	127 16.3	28 56.3	127 15.6	28 55.6	127 14.8	28 54.8	127 14.1			28 54.8	127 14.1		
10			27 41.6	125 40.1	27 40.9	125 39.4	27 40.2	125 38.8	27 39.5	125 38.2			27 39.5	125 38.2		
15			26 26.2	124 10.7	26 25.5	124 10.2	26 24.9	124 09.7	26 24.2	124 09.2			26 24.2	124 09.2		
20			25 10.8	122 47.3	25 10.2	122 46.9	25 09.6	122 46.5	25 09.0	122 46.1			25 09.0	122 46.1		
25			23 55.6	121 29.0	23 55.0	121 28.6	23 54.4	121 28.3	23 53.8	121 28.0			23 53.8	121 28.0		
19 30			+22 40.4	+120 14.9	+22 39.8	+120 14.7	+22 39.3	+120 14.4	+22 38.7	+120 14.2			+22 38.7	+120 14.2		
35			21 25.2	119 04.5	21 24.7	119 04.3	21 24.2	119 04.2	21 23.7	119 04.0			21 23.7	119 04.0		
40			20 10.1	117 57.1	20 09.6	117 57.0	20 09.1	117 57.0	20 08.7	117 56.9			20 08.7	117 56.9		
45			18 55.0	116 52.2	18 54.5	116 52.2	18 54.1	116 52.2	18 53.7	116 52.3			18 53.7	116 52.3		
50			17 39.8	115 49.4	17 39.4	115 49.5	17 39.1	115 49.6	17 38.7	115 49.7			17 38.7	115 49.7		
55			16 24.7	114 48.2	16 24.3	114 48.3	16 24.0	114 48.5	16 23.6	114 48.6			16 23.6	114 48.6		
20 00			+15 09.4	+113 48.1	+15 09.1	+113 48.3	+15 08.8	+113 48.5	+15 08.5	+113 48.7			+15 08.5	+113 48.7		
05			13 54.1	112 48.8	13 53.8	112 49.0	13 53.6	112 49.3	13 53.3	112 49.6			13 53.3	112 49.6		
10			12 38.6	111 49.7	12 38.4	111 50.1	12 38.2	111 50.4	12 37.9	111 50.8			12 37.9	111 50.8		
15			11 23.0	110 50.6	11 22.8	110 51.1	11 22.6	110 51.5	11 22.4	110 51.9			11 22.4	110 51.9		
20			10 07.1	109 51.0	10 07.0	109 51.5	10 06.8	109 52.0	10 06.7	109 52.5			10 06.7	109 52.5		
25			8 51.0	108 50.5	8 50.9	108 51.0	8 50.8	108 51.6	8 50.6	108 52.1			8 50.6	108 52.1		
20 30			+ 7 34.6	+107 48.6	+ 7 34.5	+107 49.2	+ 7 34.4	+107 49.8	+ 7 34.3	+107 50.4			+ 7 34.3	+107 50.4		
35			6 17.8	106 44.8	6 17.7	106 45.5	6 17.7	106 46.2	6 17.6	106 46.8			6 17.6	106 46.8		
40			5 00.5	105 38.5	5 00.5	105 39.3	5 00.5	105 40.1	5 00.5	105 40.9			5 00.5	105 40.9		
45			3 42.8	104 29.3	3 42.8	104 30.1	3 42.8	104 31.0	3 42.9	104 31.8			3 42.9	104 31.8		
50			2 24.5	103 16.3	2 24.5	103 17.2	2 24.6	103 18.2	2 24.7	103 19.1			2 24.7	103 19.1		
55			+ 1 05.5	101 58.7	+ 1 05.6	101 59.8	+ 1 05.7	102 00.8	+ 1 05.8	102 01.9			+ 1 05.8	102 01.9		
21 00			- 0 14.3	+100 35.7	- 0 14.1	+100 36.8	- 0 14.0	+100 38.0	- 0 13.8	+100 39.1			- 0 13.8	+100 39.1		
05			1 34.9	99 05.9	1 34.7	99 07.2	1 34.5	99 08.4	1 34.3	99 09.7			1 34.3	99 09.7		
10			2 56.6	97 27.8	2 56.4	97 29.3	2 56.1	97 30.7	2 55.9	97 32.1			2 55.9	97 32.1		
15			4 19.6	95 39.6	4 19.3	95 41.2	4 19.0	95 42.8	4 18.7	95 44.4			4 18.7	95 44.4		
20			5 44.0	93 38.5	5 43.7	93 40.3	5 43.3	93 42.1	5 43.0	93 43.9			5 43.0	93 43.9		
25			7 10.3	91 20.7	7 09.9	91 22.8	7 09.5	91 24.9	7 09.1	91 26.9			7 09.1	91 26.9		
21 30			- 8 38.9	+ 88 40.4	- 8 38.5	+ 88 42.9	- 8 38.0	+ 88 45.3	- 8 37.5	+ 88 47.7			- 8 37.5	+ 88 47.7		
35			10 10.8	85 28.0	10 10.2	85 31.0	10 09.6	85 33.9	10 09.1	85 36.8			10 09.1	85 36.8		
40			11 47.3	81 24.9	11 46.6	81 28.6	11 46.0	81 32.3	11 45.3	81 36.0			11 45.3	81 36.0		
21 42			-12 27.9	+ 79 24.9	-12 27.2	+ 79 29.2	-12 26.5	+ 79 33.4	-12 25.8	+ 79 37.5			-12 25.8	+ 79 37.5		
44			13 10.3	77 04.4	13 09.5	77 09.4	13 08.7	77 14.3	13 07.9	77 19.2			13 07.9	77 19.2		
46			13 55.3	74 11.9	13 54.4	74 18.1	13 53.5	74 24.2	13 52.6	74 30.2			13 52.6	74 30.2		
21 48			-14 45.2	+ 70 18.5	-14 44.1	+ 70 27.2	-14 43.0	+ 70 35.8	-14 41.9	+ 70 44.3			-14 41.9	+ 70 44.3		
49			15 14.3	67 29.2	15 13.0	67 41.4	15 11.6	67 53.2	15 10.2	68 04.7			15 10.2	68 04.7		
50			-15 55.5	+ 62 04.7	-15 52.2	+ 62 41.5	-15 49.4	+ 63 11.9	-15 46.9	+ 63 38.6			-15 46.9	+ 63 38.6		

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time h m	10,000 Feet		20,000 Feet		30,000 Feet		40,000 Feet	
	Duration	Width of Path mi	Duration	Width of Path mi	Duration	Width of Path mi	Duration	Width of Path mi
18 07	3 00.8	105	3 00.9	105	3 01.0	104	3 01.1	104
08	3 02.0	102	3 02.1	102	3 02.1	102	3 02.2	101
09	3 02.8	99	3 02.9	99	3 02.9	99	3 02.9	99
10	3 03.5	98	3 03.5	98	3 03.5	98	3 03.6	98
18 11	3 04.0	97	3 04.0	96	3 04.1	96	3 04.1	96
13	3 04.9	94	3 04.9	94	3 05.0	94	3 05.0	94
15	3 05.7	92	3 05.7	92	3 05.7	92	3 05.7	92
18 20	3 07.1	88	3 07.1	88	3 07.1	88	3 07.2	88
25	3 08.1	86	3 08.2	86	3 08.2	85	3 08.2	85
30	3 08.9	83	3 09.0	83	3 09.0	83	3 09.0	83
35	3 09.5	81	3 09.5	81	3 09.5	81	3 09.5	81
18 40	3 09.9	79	3 09.9	79	3 09.9	79	3 09.9	79
45	3 10.2	78	3 10.2	78	3 10.2	77	3 10.2	77
50	3 10.3	76	3 10.3	76	3 10.3	76	3 10.3	76
55	3 10.4	75	3 10.4	75	3 10.4	75	3 10.4	75
19 00	3 10.3	74	3 10.3	74	3 10.3	74	3 10.3	74
05	3 10.2	73	3 10.2	73	3 10.2	73	3 10.2	73
10	3 10.0	72	3 10.0	72	3 10.0	72	3 10.0	71
15	3 09.7	71	3 09.7	71	3 09.7	71	3 09.7	71
20	3 09.4	71	3 09.4	71	3 09.4	71	3 09.4	71
25	3 09.1	70	3 09.1	70	3 09.1	70	3 09.1	70
19 30	3 06.7	70	3 08.8	70	3 08.7	70	3 08.7	70
35	3 08.4	69	3 08.4	69	3 08.4	69	3 08.4	69
40	3 08.0	69	3 08.0	69	3 08.0	69	3 08.0	69
45	3 07.6	69	3 07.6	69	3 07.6	69	3 07.6	69
50	3 07.2	69	3 07.2	69	3 07.2	69	3 07.2	69
55	3 06.8	69	3 06.9	69	3 06.8	69	3 06.8	69
20 00	3 06.5	69	3 06.5	69	3 06.5	69	3 06.4	69
05	3 06.1	69	3 06.1	69	3 06.1	69	3 06.1	69
10	3 05.8	70	3 05.8	70	3 05.8	70	3 05.7	70
15	3 05.4	70	3 05.4	70	3 05.4	70	3 05.4	70
20	3 05.1	71	3 05.1	71	3 05.1	71	3 05.1	71
25	3 04.8	71	3 04.8	71	3 04.8	71	3 04.8	71
20 30	3 04.5	72	3 04.5	72	3 04.5	72	3 04.5	72
35	3 04.3	73	3 04.3	73	3 04.3	73	3 04.3	73
40	3 04.0	74	3 04.0	74	3 04.0	74	3 04.0	74
45	3 03.8	75	3 03.7	75	3 03.7	75	3 03.8	75
50	3 03.5	76	3 03.5	76	3 03.5	75	3 03.5	75
55	3 03.2	77	3 03.2	77	3 03.2	77	3 03.2	77
21 00	3 03.0	79	3 03.0	79	3 03.0	79	3 02.9	79
05	3 02.7	80	3 02.7	79	3 02.7	79	3 02.7	79
10	3 02.4	81	3 02.4	81	3 02.4	81	3 02.4	81
15	3 02.0	82	3 02.0	83	3 02.0	83	3 02.0	83
20	3 01.6	84	3 01.6	84	3 01.6	84	3 01.6	84
25	3 01.1	86	3 01.1	86	3 01.1	86	3 01.1	86
21 30	3 00.6	88	3 00.6	88	3 00.6	88	3 00.6	88
35	2 59.9	90	2 59.9	90	2 59.9	90	2 59.9	91
40	2 59.0	93	2 59.0	93	2 59.0	93	2 59.0	93
21 42	2 58.5	94	2 58.5	94	2 58.5	94	2 58.6	94
44	2 58.0	95	2 58.0	95	2 58.0	95	2 58.0	95
46	2 57.4	98	2 57.4	97	2 57.4	97	2 57.4	97
21 48	2 56.6	99	2 56.6	99	2 56.6	99	2 56.6	99
49	2 56.0	101	2 56.0	101	2 56.1	101	2 56.1	101
50	2 54.9	104	2 55.0	103	2 55.1	103	2 55.2	103

CENTRAL LINE OF ANNULAR ECLIPSE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
h m	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "
18 02	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	+41 23.2	+176 27.5
03	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	41 24.8	172 22.1
18 04	.. ..	.. ..	.. ..	.. ..	+41 35.4	+176 02.8	+41 21.2	+169 23.1
06	+41 48.4	+177 33.7	+41 47.6	+175 41.5	41 31.3	169 16.3	41 07.2	164 50.1
08	41 46.1	170 12.0	41 41.6	169 09.6	41 16.4	164 46.8	40 48.8	161 16.5
18 10	+41 31.3	+165 30.3	+41 25.8	+164 43.3	+40 57.2	+161 14.4	+40 27.6	+158 17.8
15	40 37.8	157 24.2	40 31.4	156 53.3	39 59.7	154 29.6	39 28.4	152 21.1
20	39 34.3	151 37.6	39 27.7	151 14.2	38 55.4	149 23.8	38 23.9	147 42.8
25	38 26.1	147 03.6	38 19.6	146 44.9	37 47.6	145 16.0	37 16.6	143 53.6
18 30	+37 15.4	+143 16.2	+37 09.0	+143 00.9	+36 37.8	+141 47.4	+36 07.5	+140 38.7
35	36 03.1	140 02.0	35 56.9	139 49.2	35 26.7	138 47.5	34 57.4	137 49.5
40	34 49.9	137 12.7	34 43.9	137 01.9	34 14.8	136 09.7	33 46.5	135 20.3
45	33 36.1	134 43.1	33 30.4	134 33.9	33 02.4	133 49.5	32 35.3	133 07.3
50	32 21.9	132 29.3	32 16.5	132 21.5	31 49.7	131 43.6	31 23.8	131 07.5
55	31 07.6	130 28.5	31 02.4	130 21.8	30 36.8	129 49.5	30 12.1	129 18.7
19 00	+29 53.1	+128 38.5	+29 48.2	+128 32.9	+29 23.9	+128 05.4	+29 00.4	+127 39.2
05	28 38.6	126 57.6	28 33.9	126 52.9	28 10.9	126 29.8	27 48.6	126 07.6
10	27 24.2	125 24.5	27 19.8	125 20.6	26 58.0	125 01.3	26 36.8	124 42.8
15	26 09.8	123 58.0	26 05.6	123 54.8	25 45.0	123 39.0	25 25.1	123 23.8
20	24 55.4	122 37.2	24 51.5	122 34.6	24 32.2	122 22.0	24 13.5	122 09.8
25	23 41.1	121 21.2	23 37.5	121 19.2	23 19.4	121 09.5	23 01.8	121 00.1
19 30	+22 26.9	+120 09.3	+22 23.5	+120 07.9	+22 06.6	+120 00.9	+21 50.2	+119 54.1
35	21 12.7	119 00.9	21 09.5	119 00.0	20 53.8	118 55.5	20 38.7	118 51.2
40	19 58.5	117 55.4	19 55.6	117 55.0	19 41.1	117 53.0	19 27.1	117 51.0
45	18 44.4	116 52.4	18 41.7	116 52.5	18 28.4	116 52.7	18 15.5	116 52.9
50	17 30.2	115 51.4	17 27.7	115 51.9	17 15.7	115 54.3	17 03.9	115 56.7
55	16 16.0	114 51.9	16 13.8	114 52.8	16 02.9	114 57.4	15 52.3	115 01.8
20 00	+15 01.7	+113 53.4	+14 59.7	+113 54.8	+14 50.0	+114 01.5	+14 40.6	+114 08.0
05	13 47.3	112 55.7	13 45.6	112 57.5	13 37.0	113 06.3	13 28.8	113 14.8
10	12 32.8	111 58.4	12 31.3	112 00.6	12 23.9	112 11.4	12 16.8	112 21.9
15	11 18.1	111 00.9	11 16.8	111 03.5	11 10.7	111 16.4	11 04.7	111 28.9
20	10 03.2	110 03.0	10 02.2	110 06.0	9 57.2	110 21.0	9 52.3	110 35.6
25	8 48.0	109 04.2	8 47.2	109 07.7	8 43.4	109 24.8	8 39.8	109 41.4
20 30	+ 7 32.5	+108 04.0	+ 7 32.0	+108 08.0	+ 7 29.4	+108 27.4	+ 7 26.9	+108 46.1
35	6 16.7	107 02.1	6 16.4	107 06.5	6 15.0	107 28.2	6 13.7	107 49.2
40	5 00.4	105 57.8	5 00.4	106 02.7	5 00.2	106 26.9	5 00.1	106 50.2
45	3 43.7	104 50.7	3 43.9	104 56.1	3 45.0	105 22.9	3 46.1	105 48.7
50	2 26.4	103 39.9	2 26.9	103 46.0	2 29.2	104 15.5	2 31.5	104 44.1
55	+ 1 08.4	102 24.9	+ 1 09.2	102 31.5	+ 1 12.9	103 04.2	1 16.4	103 35.7
21 00	- 0 10.3	+101 04.6	- 0 09.2	+101 11.9	- 0 04.2	+101 48.0	+ 0 00.6	+102 22.7
05	1 29.8	99 37.9	1 28.5	99 46.1	1 22.1	100 25.9	- 1 15.9	101 04.2
10	2 50.3	98 03.5	2 48.7	98 12.5	2 40.9	98 56.7	2 33.3	99 39.1
15	4 12.1	96 19.4	4 10.1	96 29.6	4 00.8	97 18.8	3 51.8	98 05.9
20	5 35.2	94 23.4	5 32.9	94 34.8	5 22.0	95 30.1	5 11.4	96 22.8
25	7 00.1	92 12.0	6 57.4	92 24.9	6 44.7	93 27.7	6 32.5	94 27.2
21 30	- 8 27.1	+ 89 40.0	- 8 24.1	+ 89 55.1	- 8 09.4	+ 91 07.4	- 7 55.4	+ 92 15.5
35	9 57.0	86 39.4	9 53.5	86 57.3	9 36.6	88 22.7	9 20.6	89 42.3
40	11 31.1	82 55.0	11 27.0	83 17.3	11 07.3	85 02.4	10 48.7	86 38.5
45	13 12.1	77 52.0	13 07.1	78 22.7	12 43.3	80 43.5	12 21.3	82 47.2
21 47	-13 56.0	+ 75 08.6	-13 50.4	+ 75 45.9	-13 24.1	+ 78 32.3	-13 00.2	+ 80 53.8
49	14 44.2	71 33.5	14 37.4	72 23.7	14 07.1	75 53.9	13 40.6	78 41.8
51	-15 44.3	+ 65 25.6	-15 33.5	+ 67 07.3	14 54.0	72 27.9	14 23.4	76 01.8
21 53	.. ..	.. ..	.. ..	.. ..	-15 51.0	+ 66 54.3	-15 10.3	+ 72 31.6
54	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	15 36.7	70 08.4
55	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	-16 08.6	+ 66 36.4

DURATION OF ANNULAR PHASE AND WIDTH OF PATH ON CENTRAL LINE

Universal Time	80 Km		100 Km		200 Km		300 Km	
	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path	Duration	Width of Path
h m	m s	mi	m s	mi	m s	mi	m s	mi
18 02	. . . .	...	. . . .	...	. . . .	...	3 01.6	103
03	. . . .	...	. . . .	...	. . . .	...	3 02.6	100
18 04	. . . .	...	. . . .	...	3 01.7	102	3 03.3	98
06	3 01.4	103	3 01.9	102	3 03.4	98	3 04.4	95
08	3 03.2	99	3 03.4	98	3 04.5	96	3 05.3	93
18 10	3 04.3	96	3 04.5	95	3 05.3	93	3 06.1	91
15	3 06.2	91	3 06.3	90	3 07.0	89	3 07.6	87
20	3 07.5	87	3 07.6	87	3 08.1	86	3 08.6	85
25	3 08.5	84	3 08.6	85	3 09.0	83	3 09.4	82
18 30	3 09.2	82	3 09.3	82	3 09.7	81	3 10.0	80
35	3 09.8	80	3 09.8	80	3 10.1	79	3 10.4	78
40	3 10.1	79	3 10.2	78	3 10.4	78	3 10.7	76
45	3 10.3	77	3 10.4	76	3 10.6	76	3 10.8	75
50	3 10.5	75	3 10.5	76	3 10.7	74	3 10.8	74
55	3 10.4	74	3 10.5	74	3 10.6	74	3 10.7	72
19 00	3 10.4	73	3 10.4	73	3 10.5	72	3 10.6	71
05	3 10.2	72	3 10.2	72	3 10.3	71	3 10.3	71
10	3 10.0	71	3 10.0	71	3 10.0	70	3 10.0	70
15	3 09.7	71	3 09.7	71	3 09.7	69	3 09.7	69
20	3 09.4	70	3 09.4	70	3 09.4	69	3 09.3	69
25	3 09.1	70	3 09.1	69	* 3 09.0	69	3 09.0	68
19 30	3 08.7	69	3 08.7	69	3 08.6	69	3 08.6	68
35	3 08.3	69	3 08.3	68	3 08.2	68	3 08.1	67
40	3 07.9	68	3 07.9	68	3 07.8	68	3 07.7	67
45	3 07.5	68	3 07.5	68	3 07.4	68	3 07.2	67
50	3 07.1	68	3 07.1	68	3 07.0	68	3 06.8	67
55	3 06.8	68	3 06.7	68	3 06.6	68	3 06.4	67
20 00	3 06.4	68	3 06.3	68	3 06.2	68	3 06.0	67
05	3 06.0	69	3 06.0	68	3 05.8	68	3 05.6	67
10	3 05.7	69	3 05.6	69	3 05.5	69	3 05.3	67
15	3 05.3	70	3 05.3	69	3 05.1	69	3 05.0	68
20	3 05.0	70	3 05.0	70	3 04.8	69	3 04.6	69
25	3 04.7	71	3 04.7	71	3 04.5	69	3 04.4	69
20 30	3 04.4	71	3 04.4	72	3 04.3	70	3 04.1	70
35	3 04.2	72	3 04.2	72	3 04.0	71	3 03.8	71
40	3 03.9	73	3 03.9	73	3 03.8	72	3 03.6	71
45	3 03.7	74	3 03.7	74	3 03.5	74	3 03.4	72
50	3 03.4	75	3 03.4	75	3 03.3	74	3 03.2	74
55	3 03.2	76	3 03.2	76	3 03.1	75	3 03.0	75
21 00	3 02.9	78	3 02.9	77	3 02.8	77	3 02.7	76
05	3 02.6	79	3 02.6	79	3 02.6	78	3 02.5	77
10	3 02.4	80	3 02.4	81	3 02.3	79	3 02.3	79
15	3 02.0	82	3 02.0	82	3 02.0	81	3 02.0	81
20	3 01.6	83	3 01.7	84	3 01.7	83	3 01.7	82
25	3 01.2	85	3 01.2	85	3 01.3	84	3 01.3	84
21 30	3 00.7	87	3 00.7	87	3 00.8	86	3 00.9	85
35	3 00.0	90	3 00.1	89	3 00.3	88	3 00.4	87
40	2 59.2	92	2 59.2	92	2 59.5	91	2 59.7	90
45	2 58.1	95	2 58.2	95	2 58.6	93	2 58.9	92
21 47	2 57.5	96	2 57.6	97	2 58.1	95	2 58.4	93
49	2 56.7	99	2 56.9	98	2 57.5	96	2 58.0	95
51	2 55.5	102	2 55.8	101	2 56.7	98	2 57.4	96
21 53	. . . .	...	. . . .	...	2 55.6	101	2 56.6	98
54	. . . .	...	. . . .	...	. . . .	...	2 56.1	100
55	. . . .	...	. . . .	...	. . . .	...	2 55.4	101

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Universal Time	Central Line		First Contact			Second Contact		
	Latitude	Longitude	Universal Time	P	V	Universal Time	P	V
h m	° ' "	° ' "	h m s	° ' "	° ' "	h m s	° ' "	° ' "
18 07	+41 51.8	-178 55.0	.. .. .	...	...	18 05 29.6	298	346
08	41 59.9	+175 22.5	.. .. .	...	...	18 06 29.0	299	347
09	41 57.9	171 49.7	.. .. .	...	...	18 07 28.6	299	348
10	41 52.2	169 03.1	17 02 41.7	298	347	18 08 28.3	300	348
18 11	+41 44.5	+166 42.6	17 02 42.6	299	347	18 09 28.0	301	349
13	41 25.4	162 49.3	17 02 59.3	300	349	18 11 27.5	302	349
15	41 03.3	159 36.4	17 03 28.7	300	350	18 13 27.2	302	350
18 20	+40 00.7	+153 15.8	17 05 14.3	302	352	18 18 26.5	304	351
25	38 52.5	148 21.3	17 07 27.5	304	354	18 23 25.9	306	352
30	37 41.2	144 19.7	17 09 58.4	305	356	18 28 25.6	307	353
35	36 28.2	140 54.9	17 12 42.4	306	358	18 33 25.3	309	353
18 40	+35 14.1	+137 57.3	17 15 37.1	307	359	18 38 25.1	310	354
45	33 59.3	135 20.9	17 18 40.9	308	1	18 43 25.0	311	354
50	32 44.1	133 01.4	17 21 52.8	310	3	18 48 24.9	312	354
55	31 28.8	130 55.8	17 25 12.1	311	4	18 53 24.8	313	353
19 00	+30 13.3	+129 01.6	17 28 38.5	312	6	18 58 24.9	314	353
05	28 57.8	127 17.1	17 32 11.4	313	7	19 03 25.0	315	352
10	27 42.3	125 40.7	17 35 50.8	313	8	19 08 25.1	316	350
15	26 26.8	124 11.2	17 39 36.5	314	10	19 13 25.2	317	349
20	25 11.5	122 47.7	17 43 28.3	315	11	19 18 25.3	318	346
25	23 56.2	121 29.3	17 47 26.2	316	12	19 23 25.5	318	343
19 30	+22 40.9	+120 15.1	17 51 30.0	317	13	19 28 25.7	319	339
35	21 25.7	119 04.6	17 55 39.8	317	14	19 33 25.9	319	335
40	20 10.5	117 57.1	17 59 55.6	318	15	19 38 26.0	320	328
45	18 55.4	116 52.2	18 04 17.2	319	16	19 43 26.3	320	321
50	17 40.2	115 49.3	18 08 44.8	319	17	19 48 26.5	320	311
55	16 25.0	114 48.0	18 13 18.2	320	18	19 53 26.6	321	301
20 00	+15 09.7	+113 47.9	18 17 57.5	320	18	19 58 26.8	321	290
05	13 54.4	112 48.5	18 22 42.9	321	19	20 03 27.0	321	278
10	12 38.9	111 49.4	18 27 34.4	321	20	20 08 27.2	321	268
15	11 23.2	110 50.2	18 32 31.9	321	20	20 13 27.4	321	259
20	10 07.3	109 50.6	18 37 35.6	321	20	20 18 27.5	321	252
25	8 51.1	108 50.0	18 42 45.8	321	20	20 23 27.7	321	245
20 30	+ 7 34.6	+107 48.0	18 48 02.5	321	19	20 28 27.8	320	240
35	6 17.8	106 44.1	18 53 25.9	321	15	20 33 27.9	320	236
40	5 00.5	105 37.8	18 58 56.2	321	324	20 38 28.0	320	232
45	3 42.7	104 28.4	19 04 34.1	321	215	20 43 28.2	319	229
50	2 24.4	103 15.3	19 10 19.5	321	210	20 48 28.3	318	226
55	+ 1 05.4	101 57.7	19 16 13.2	320	208	20 53 28.4	318	223
21 00	- 0 14.4	+100 34.5	19 22 15.6	320	207	20 58 28.6	317	220
05	1 35.1	99 04.6	19 28 27.5	319	206	21 03 28.7	316	218
10	2 56.9	97 26.4	19 34 50.0	319	206	21 08 28.9	316	216
15	4 19.9	95 38.0	19 41 24.1	318	205	21 13 29.0	315	214
20	5 44.4	93 36.7	19 48 11.2	317	204	21 18 29.2	313	212
25	7 10.7	91 18.6	19 55 13.7	316	204	21 23 29.5	312	210
21 30	- 8 39.4	+ 88 38.0	20 02 34.7	314	203	21 28 29.8	311	207
35	10 11.3	85 25.1	20 10 19.5	313	202	21 33 30.1	310	205
40	11 48.0	81 21.1	20 18 37.9	311	200	21 38 30.5	308	203
21 42	-12 28.6	+ 79 20.7	20 22 11.2	310	200	21 40 30.8	307	202
44	13 11.1	76 59.5	20 25 56.4	309	199	21 42 31.0	306	201
46	13 56.2	74 05.7	20 29 59.7	308	198	21 44 31.3	305	199
21 48	-14 46.4	+ 70 09.6	20 34 36.5	306	197	21 46 31.7	304	198
49	15 15.8	67 16.8	20 37 23.7	305	197	21 47 32.0	303	197
50	-15 59.8	+ 61 14.6	20 41 49.2	304	195	21 48 32.6	301	195

ANNULAR SOLAR ECLIPSE OF 11 SEPTEMBER 1969

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LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

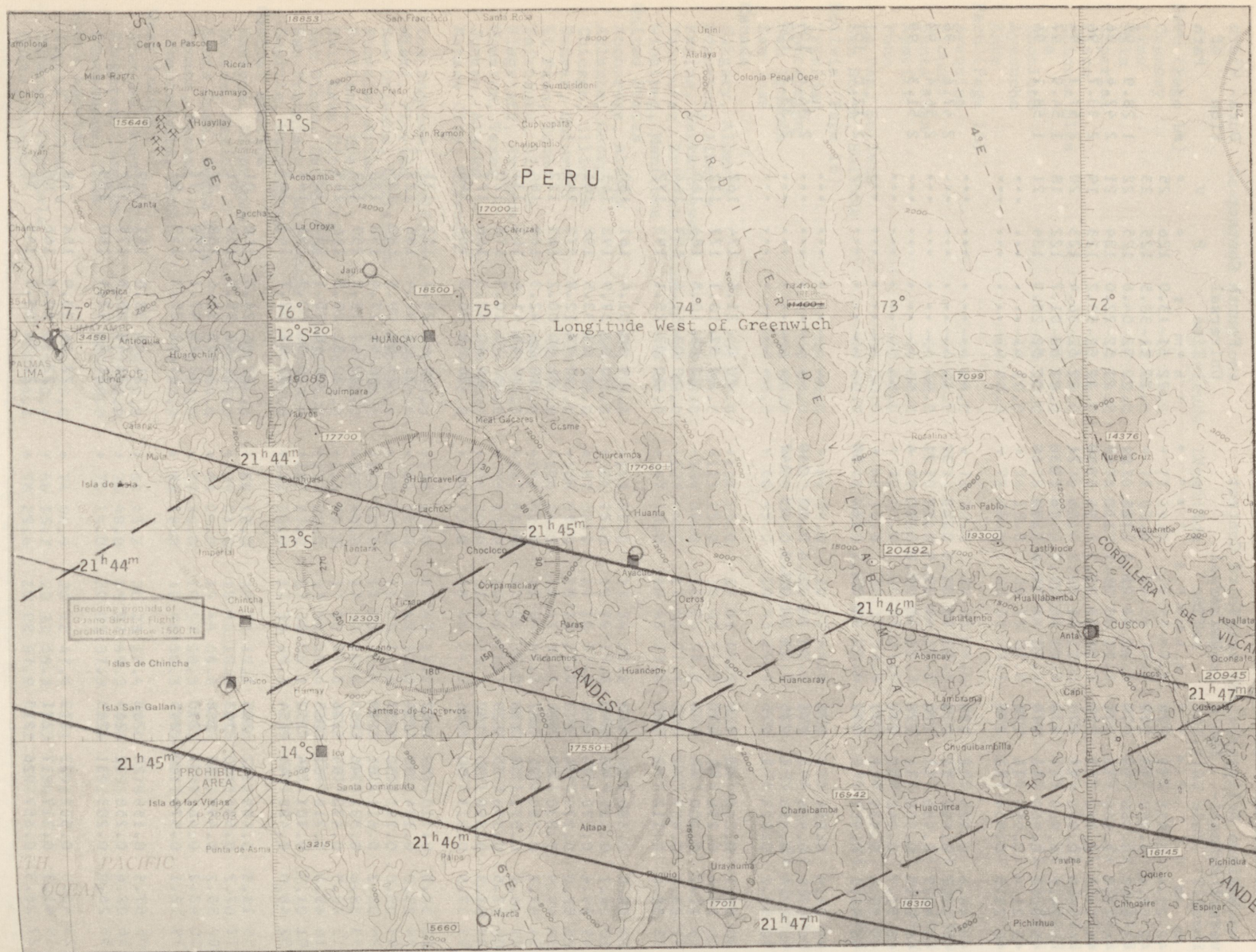
Maximum Eclipse				Third Contact				Fourth Contact				Dura- tion	Width of Path
Universal Time	Magni- tude	Sun's Alt.	Sun's Az.	Universal Time	P.	V.	Universal Time	P.	V.				
h m s		°	°	h m s	°	°	h m s	°	°	m s			
18 07 00.0	0.955	4	88	18 08 30.4	118	166	19 15 49.8	119	167	3 00.8	105		
18 08 00.0	0.956	9	92	18 09 31.0	119	167	19 19 22.5	121	167	3 02.0	101		
18 09 00.0	0.957	11	94	18 10 31.4	119	168	19 22 02.5	121	167	3 02.8	100		
18 10 00.0	0.958	14	96	18 11 31.7	120	168	19 24 23.6	122	167	3 03.4	98		
18 11 00.0	0.958	16	98	18 12 32.0	121	169	19 26 34.0	123	167	3 04.0	97		
18 13 00.0	0.959	19	101	18 14 32.5	122	169	19 30 34.8	124	166	3 05.0	94		
18 15 00.0	0.960	22	104	18 16 32.8	122	170	19 34 18.4	125	166	3 05.6	92		
18 20 00.0	0.961	27	109	18 21 33.5	124	171	19 42 51.8	127	164	3 07.0	88		
18 25 00.0	0.962	32	113	18 26 34.1	126	172	19 50 44.0	129	163	3 08.2	86		
18 30 00.0	0.963	37	117	18 31 34.4	127	173	19 58 08.0	130	160	3 08.8	83		
18 35 00.0	0.964	40	120	18 36 34.7	129	173	20 05 10.3	131	157	3 09.4	81		
18 40 00.0	0.965	44	123	18 41 34.9	130	173	20 11 54.7	133	154	3 09.8	79		
18 45 00.0	0.966	47	126	18 46 35.0	131	173	20 18 23.9	134	150	3 10.0	78		
18 50 00.0	0.966	50	129	18 51 35.1	132	173	20 24 39.9	135	145	3 10.2	76		
18 55 00.0	0.967	53	132	18 56 35.2	133	173	20 30 44.1	136	140	3 10.4	75		
19 00 00.0	0.967	56	135	19 01 35.1	134	172	20 36 37.6	136	134	3 10.2	74		
19 05 00.0	0.968	59	138	19 06 35.0	135	171	20 42 21.6	137	128	3 10.0	73		
19 10 00.0	0.968	62	142	19 11 34.9	136	169	20 47 56.6	138	122	3 09.8	72		
19 15 00.0	0.968	64	145	19 16 34.8	137	167	20 53 23.8	138	115	3 09.6	71		
19 20 00.0	0.969	66	149	19 21 34.7	138	165	20 58 43.3	139	109	3 09.4	71		
19 25 00.0	0.969	69	154	19 26 34.5	138	161	21 03 56.0	139	103	3 09.0	70		
19 30 00.0	0.969	71	159	19 31 34.3	139	157	21 09 02.2	139	97	3 08.6	70		
19 35 00.0	0.969	72	165	19 36 34.1	139	152	21 14 02.3	139	92	3 08.2	69		
19 40 00.0	0.969	74	172	19 41 34.0	140	146	21 18 56.7	139	87	3 08.0	69		
19 45 00.0	0.970	76	181	19 46 33.7	140	138	21 23 45.7	140	82	3 07.4	69		
19 50 00.0	0.970	77	191	19 51 33.5	140	128	21 28 29.4	140	78	3 07.0	69		
19 55 00.0	0.970	77	202	19 56 33.4	141	118	21 33 08.1	140	74	3 06.8	69		
20 00 00.0	0.970	77	214	20 01 33.2	141	107	21 37 42.1	139	71	3 06.4	69		
20 05 00.0	0.970	77	225	20 06 33.0	141	96	21 42 11.3	139	67	3 06.0	69		
20 10 00.0	0.970	76	235	20 11 32.8	141	86	21 46 36.1	139	64	3 05.6	70		
20 15 00.0	0.970	75	244	20 16 32.6	141	78	21 50 56.3	139	62	3 05.2	70		
20 20 00.0	0.970	73	251	20 21 32.5	141	71	21 55 12.2	138	59	3 05.0	71		
20 25 00.0	0.969	71	257	20 26 32.3	141	65	21 59 23.6	138	56	3 04.6	71		
20 30 00.0	0.969	69	262	20 31 32.2	140	60	22 03 30.6	138	54	3 04.4	72		
20 35 00.0	0.969	67	266	20 36 32.1	140	56	22 07 33.1	137	52	3 04.2	73		
20 40 00.0	0.969	65	270	20 41 32.0	140	52	22 11 31.2	137	49	3 04.0	74		
20 45 00.0	0.969	62	272	20 46 31.8	139	49	22 15 24.8	136	47	3 03.6	75		
20 50 00.0	0.968	60	275	20 51 31.7	138	46	22 19 13.5	135	45	3 03.4	76		
20 55 00.0	0.968	57	276	20 56 31.6	138	43	22 22 57.4	135	43	3 03.2	77		
21 00 00.0	0.968	54	278	21 01 31.4	137	41	22 26 36.1	134	41	3 02.8	78		
21 05 00.0	0.967	52	279	21 06 31.3	136	38	22 30 09.3	133	39	3 02.6	80		
21 10 00.0	0.967	48	280	21 11 31.1	135	36	22 33 36.5	132	37	3 02.2	81		
21 15 00.0	0.966	45	281	21 16 31.0	135	34	22 36 57.1	131	34	3 02.0	82		
21 20 00.0	0.965	42	281	21 21 30.8	133	32	22 40 10.1	130	32	3 01.6	85		
21 25 00.0	0.965	38	281	21 26 30.5	132	30	22 43 14.3	129	30	3 01.0	86		
21 30 00.0	0.964	34	281	21 31 30.2	131	28	22 46 07.6	128	28	3 00.4	88		
21 35 00.0	0.963	29	281	21 36 29.9	130	25	22 48 46.4	127	25	2 59.8	90		
21 40 00.0	0.961	24	280	21 41 29.5	128	23	22 51 03.7	125	23	2 59.0	93		
21 42 00.0	0.961	21	280	21 43 29.2	127	22	22 51 49.4	124	22	2 58.4	94		
21 44 00.0	0.960	18	279	21 45 29.0	126	21	22 52 26.8	124	20	2 58.0	96		
21 46 00.0	0.959	15	279	21 47 28.7	125	20	.. .. .	...	...	2 57.4	97		
21 48 00.0	0.958	11	277	21 49 28.3	124	18	.. .. .	...	...	2 56.6	99		
21 49 00.0	0.957	8	277	21 50 28.0	123	17	.. .. .	...	...	2 56.0	101		
21 50 00.0	0.956	2	275	21 51 27.4	121	15	.. .. .	...	...	2 54.8	104		

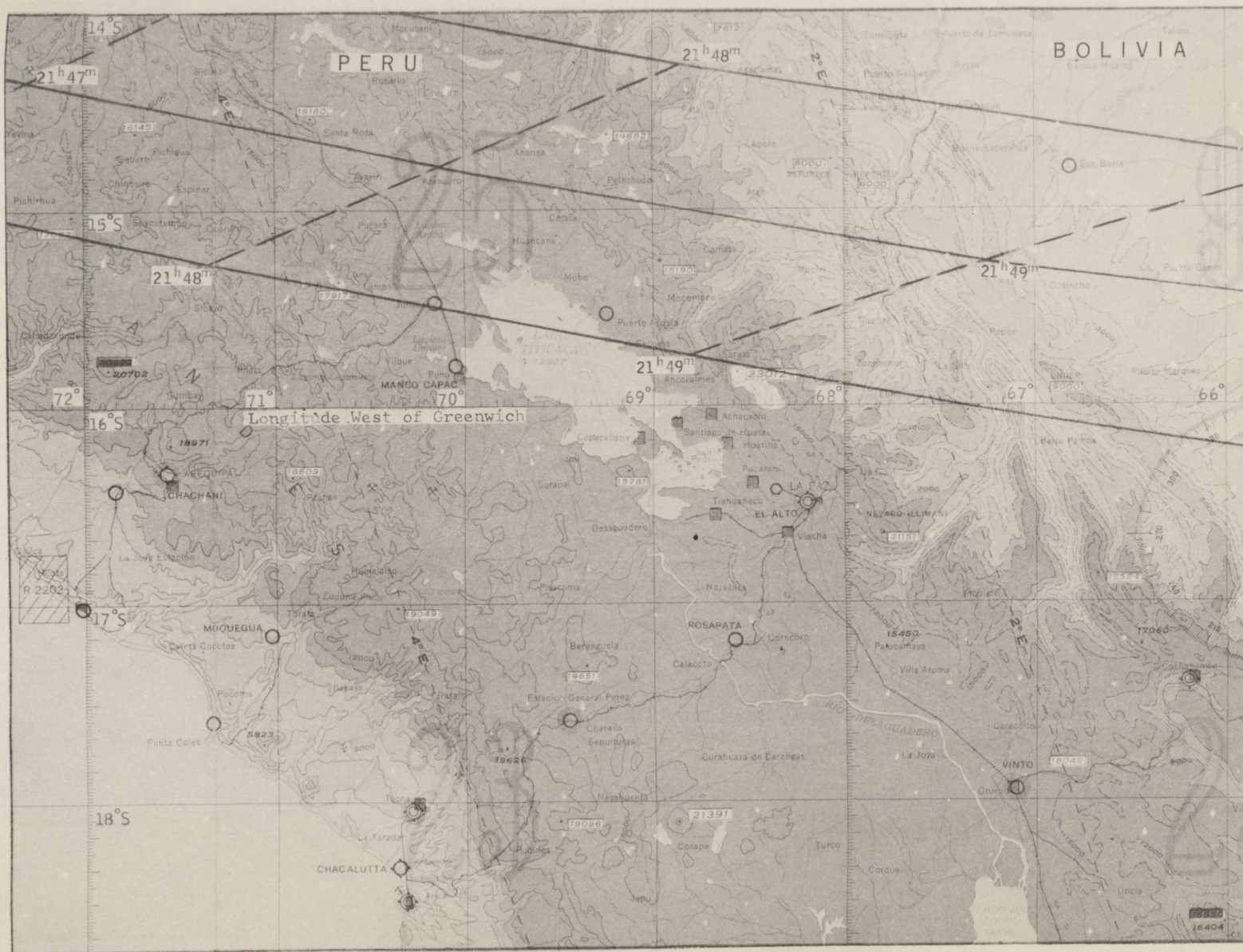
LOCAL CIRCUMSTANCES

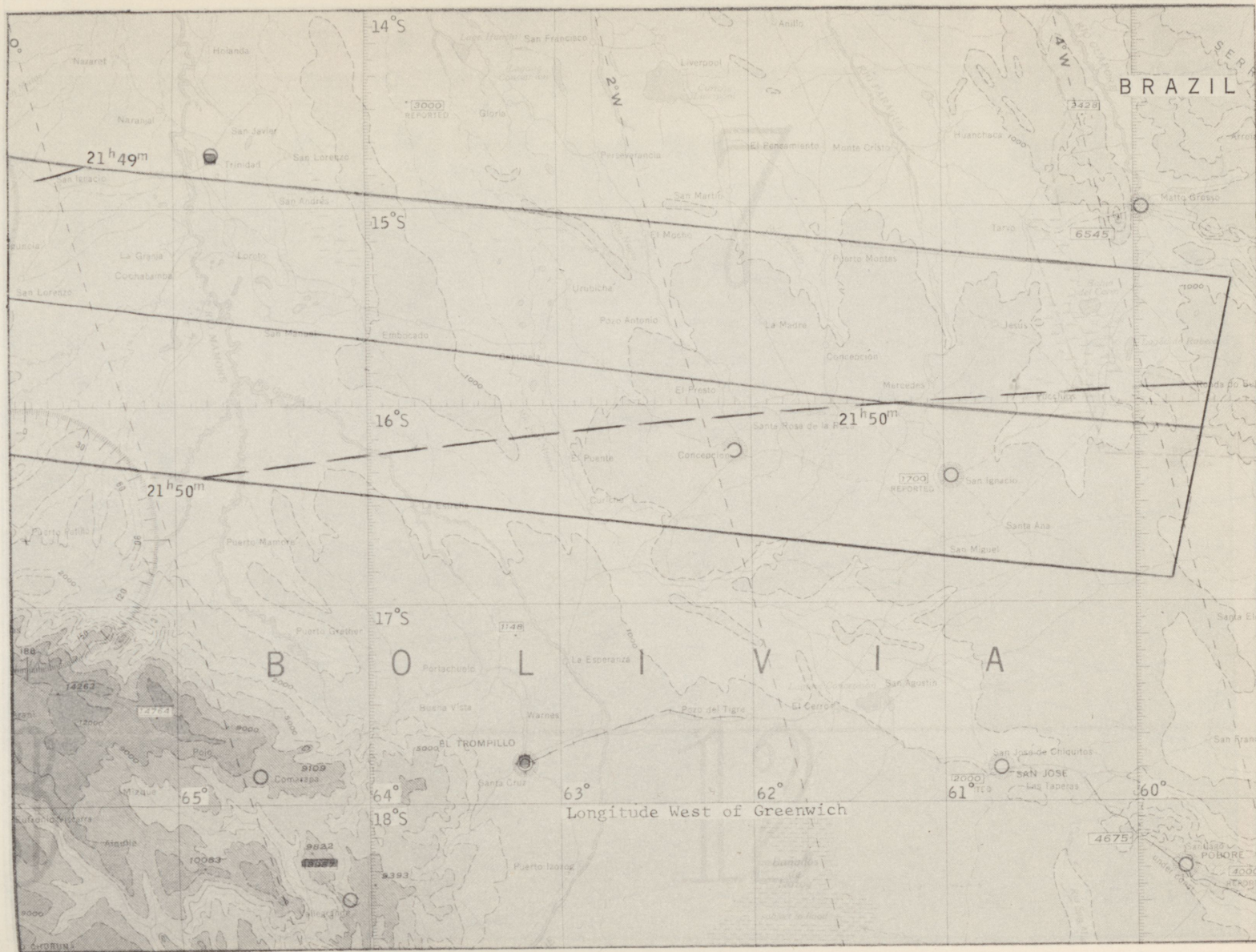
Geographic Locations	Latitude Longitude		First Contact Universal Time			Second Contact Universal Time		P °	V °	
			h	m	s	h	m			
Peru (Page 14)										
Chancay	-11 35.0	+ 77 14.0	20	23	42.8	307	198			
Lima	-12 06.0	+ 77 03.0	20	24	33.7	307	199			
Mala	-12 40.0	+ 76 36.0	20	25	46.5	308	199			
Imperial	-13 04.0	+ 76 21.0	20	26	32.3	308	199			
Pisco	-13 46.0	+ 76 12.0	20	27	32.3	309	199			
Chincha Alta	-13 25.0	+ 76 07.0	20	27	13.0	309	199			
Ica	-14 05.0	+ 75 43.0	20	28	26.5	309	199			
Chocloco	-13 10.0	+ 75 05.0	20	28	09.9	307	198			
Ayacucho	-13 10.0	+ 74 15.0	20	29	02.8	307	198			
Anta	-13 30.0	+ 72 08.0	20	31	35.1	306	197			
Peru (Page 15)										
Arequipa	-16 24.0	+ 71 32.0	20	35	04.4	310	198			
Sicuani	-14 21.0	+ 71 13.0	20	33	20.1	306	197			
Santa Rosa	-14 38.0	+ 70 45.0	20	34	02.2	307	197			
Ayaviri	-14 53.0	+ 70 35.0	20	34	25.7	307	197			
Puno	-15 53.0	+ 70 03.0	20	35	51.0	308	198			
La Paz, Bolivia	-16 30.0	+ 68 10.0	20	37	53.5	308	198			
San Borja, Bolivia	-14 50.0	+ 66 52.0	20	37	20.6	305	196			
Bolivia (Page 16)										
Trinidad	-14 46.0	+ 64 50.0	20	38	45.5	303	195			
Concepción	-16 15.0	+ 62 08.0	20	41	31.3	304	196			
San Ignacio	-16 23.0	+ 60 59.0	20	42	13.9	304	195			
San José	-17 53.0	+ 60 45.0	20	43	24.8	306	196			
Canada										
Calgary, Alberta	+51 05.0	+114 05.0	17	59	04.9	267	285			
Edmonton, Alberta	+53 34.0	+113 25.0	18	03	51.0	262	278			
Regina, Saskatchewan	+50 30.0	+104 38.0	18	20	57.2	258	265			
Vancouver, British Columbia	+49 13.0	+123 06.0	17	40	27.4	276	305			
Winnipeg, Manitoba	+49 53.0	+ 97 10.0	18	43	23.0	249	245			
United States										
Anchorage, Alaska	+61 10.0	+149 55.0	17	34	20.8	264	291			
Atlanta, Georgia	+33 45.0	+ 84 25.0	19	26	15.8	253	214			
Chicago, Illinois	+41 43.0	+ 87 38.0	19	14	57.8	245	221			
Denver, Colorado	+39 41.0	+104 57.0	18	13	27.0	276	290			
El Paso, Texas	+31 48.0	+106 24.0	18	11	31.1	289	311			
Fairbanks, Alaska	+64 49.0	+147 52.0	17	44	44.7	257	280			
Flagstaff, Arizona	+35 11.5	+111 45.5	17	56	35.0	290	321			
Houston, Texas	+29 45.0	+ 95 25.0	18	46	21.1	277	263			
Juneau, Alaska	+58 20.0	+134 20.0	17	40	22.7	265	291			
Kansas City, Missouri	+39 02.0	+ 94 33.0	18	46	24.2	263	252			
Los Angeles, California	+34 07.0	+118 18.0	17	43	17.2	298	339			
Miami, Florida	+25 47.0	+ 80 11.0	19	43	53.0	257	202			
New Orleans, Louisiana	+30 00.0	+ 90 03.3	19	05	14.8	268	238			
Phoenix, Arizona	+33 25.0	+112 10.0	17	56	22.4	293	326			
Portland, Oregon	+45 32.0	+122 40.0	17	37	38.6	282	315			
Salt Lake City, Utah	+40 45.0	+111 55.0	17	56	03.8	282	307			
San Diego, California	+32 41.0	+117 08.0	17	46	14.6	299	340			
San Francisco, California	+37 45.0	+122 27.0	17	35	06.1	295	336			
Seattle, Washington	+47 36.0	+122 20.0	17	39	59.2	279	309			
Central America										
Managua, Nicaragua	+12 06.0	+ 86 18.0	19	35	15.1	286	212			
Mexico, Mexico	+19 25.0	+ 99 01.0	18	46	18.2	295	283			
Santa José, Costa Rica	+ 9 59.0	+ 84 04.0	19	44	08.6	285	207			
Panama, Panama	+ 8 57.0	+ 79 30.0	19	57	08.3	281	199			
Tonantzintla, Mexico	+19 02.0	+ 98 18.8	18	48	58.3	295	277			
West Indies										
Arecibo, Puerto Rico	+18 20.8	+ 66 45.2	20	23	22.4	250	179			
Kingston, Jamaica	+17 58.0	+ 76 48.0	19	57	49.3	264	195			
Guantanamo, Cuba	+20 09.0	+ 75 14.0	20	01	37.3	258	192			
South America										
Bogotá, Columbia	+ 4 35.9	+ 74 04.9	20	12	47.4	281	193			
Caracas, Venezuela	+10 30.4	+ 66 55.7	20	22	58.3	265	184			
Quito, Ecuador	- 0 14.0	+ 78 29.6	20	08	47.9	292	197			

LOCAL CIRCUMSTANCES

Maximum Eclipse				Third Contact				Fourth Contact				Dura- Width	
Universal	Magni-	Sun's		Universal	P	V		Universal	P	V		tion	of
Time	tude	Alt. Az.		Time				Time				m s	Path
h m s		° °		h m s	° °	° °		h m s	° °	° °			mi
21 42 22.4	0.938	19 279						22 51 13.0	126	25			
21 42 58.4	0.950	19 279						22 51 38.5	125	23			
21 43 44.2	0.960	18 279		21 44 28.7	186	81		22 52 04.6	125	22	1 28.9	95	
21 44 13.5	0.960	18 279		21 45 34.7	150	45		22 52 22.0	124	21	2 42.4	96	
21 44 54.5	0.960	17 279		21 46 11.3	96	350		22 52 50.2	123	19	2 33.7	96	
21 44 38.9	0.960	17 279		21 46 07.7	126	21		22 52 36.4	123	20	2 57.7	96	
21 45 24.2	0.960	17 279		21 46 21.7	76	330		22 53 01.7	122	18	1 54.9	97	
21 45 00.5	0.960	16 279		21 45 59.6	174	69		22 52 28.9	124	21	1 58.1	96	
21 45 21.4	0.958	16 278						.. .. .	...	...			
21 46 28.5	0.954	13 278						.. .. .	...	...			
									...	...			
21 48 44.6	0.925	12 278						.. .. .	...	...			
21 47 27.7	0.958	12 278		21 48 51.5	143	37		.. .. .	...	...	2 47.6	98	
21 47 48.7	0.958	11 278		21 49 16.9	127	21		.. .. .	...	...	2 56.4	99	
21 48 02.3	0.958	11 278		21 49 28.0	110	4		.. .. .	...	...	2 51.3	99	
21 48 51.7	0.948	10 278						.. .. .	...	...			
21 49 39.4	0.939	8 277						.. .. .	...	...			
21 48 48.1	0.957	7 277		21 49 54.1	164	59		.. .. .	...	...	2 12.0	101	
									...	...			
21 49 04.4	0.954	5 276						.. .. .	...	...			
21 50 07.1	0.956	2 275		21 51 25.4	95	349		.. .. .	...	...	2 36.6	104	
21 50 12.4	0.956	1 275		21 51 29.3	93	347		.. .. .	...	...	2 33.7	103	
21 50 55.2	0.923	1 275						.. .. .	...	...			
									...	...			
19 00 52.7	0.310	43 169						20 03 21.6	174	167			
19 00 15.4	0.258	41 170						19 57 10.1	177	172			
19 13 11.2	0.200	44 186						20 05 10.8	184	169			
18 51 03.4	0.457	42 153						20 03 51.6	163	164			
19 23 38.0	0.112	43 200						20 03 25.1	193	172			
18 30 59.5	0.380	22 123						19 30 01.4	161	180			
20 10 24.1	0.125	43 240						20 52 37.9	192	141			
19 49 39.4	0.078	44 225						20 23 33.5	198	161			
19 25 52.0	0.374	54 193						20 37 12.8	172	143			
19 36 49.9	0.530	62 198						21 00 00.2	163	122			
18 34 57.7	0.283	21 127						19 26 42.3	169	184			
19 21 44.7	0.571	59 179						20 46 41.6	161	131			
20 00 17.5	0.356	55 229						21 10 10.3	174	120			
18 39 31.3	0.358	30 140						19 40 42.3	166	177			
19 43 37.5	0.213	50 216						20 39 00.0	184	146			
19 12 32.8	0.710	59 162						20 43 28.1	152	131			
20 34 25.0	0.174	38 254						21 21 37.4	185	122			
20 09 05.0	0.261	50 237						21 09 09.5	180	125			
19 24 00.2	0.611	61 179						20 51 17.4	158	126			
18 53 38.6	0.532	46 153						20 12 12.3	159	158			
19 13 32.5	0.470	54 176						20 31 20.5	166	145			
19 16 45.8	0.718	61 165						20 48 25.1	152	126			
19 01 01.3	0.701	54 152						20 30 00.7	151	143			
18 52 48.0	0.482	44 154						20 07 52.7	162	161			
20 55 19.3	0.489	42 265						22 06 26.3	160	81			
20 17 07.2	0.586	60 243						21 40 55.8	159	91			
21 02 55.2	0.499	38 268						22 12 32.6	158	77			
21 10 43.2	0.462	31 270						22 15 47.1	159	77			
20 19 18.1	0.579	60 245						21 42 25.3	159	91			
21 05 57.5	0.159	20 268						21 45 38.0	181	109			
20 56 02.6	0.258	32 264						21 49 05.5	175	102			
20 53 26.9	0.203	31 263						21 41 12.4	180	109			
21 23 46.0	0.502	23 273						22 26 23.9	154	68			
21 19 41.3	0.317	17 271						22 10 59.5	166	86			
21 27 26.3	0.657	26 275						22 36 05.5	145	54			

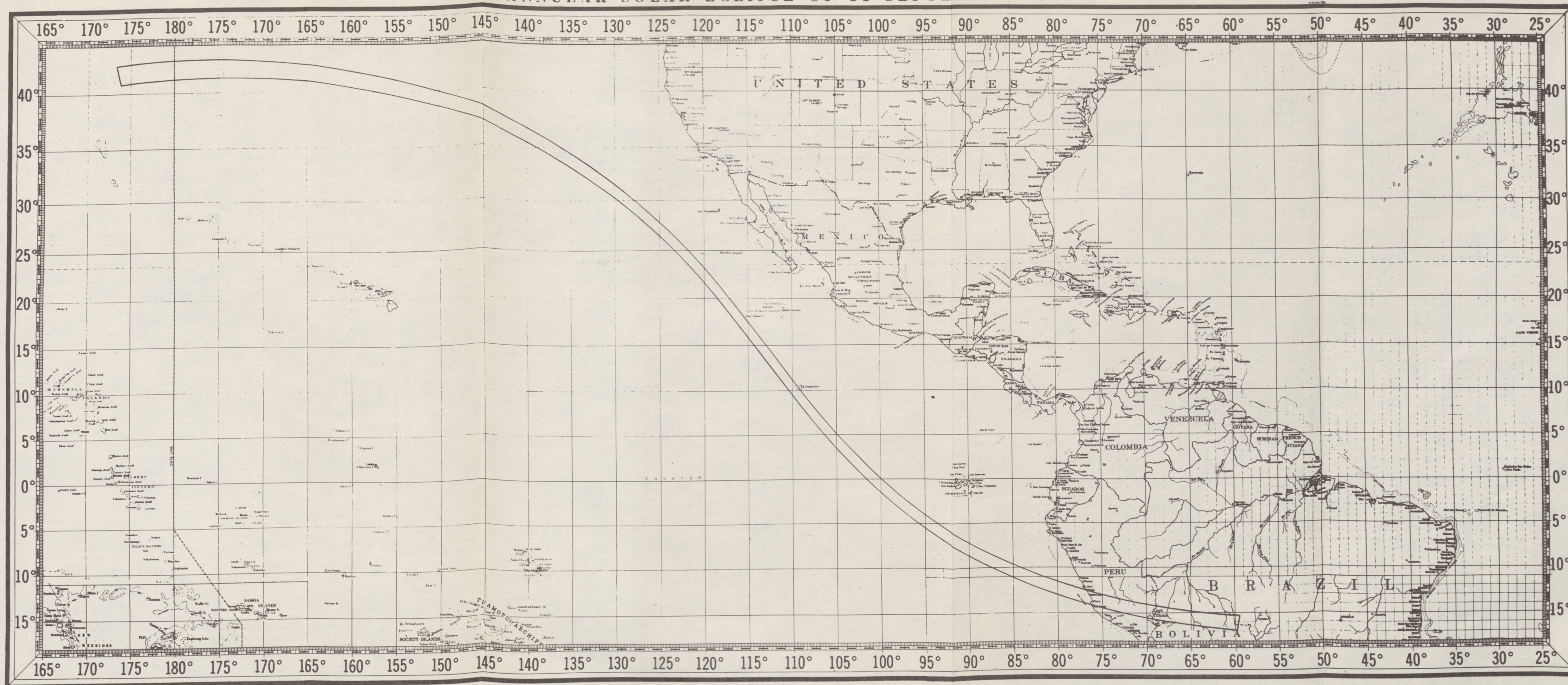






ANNULAR SOLAR ECLIPSE OF 11 SEPTEMBER 1969

17



CORRECTED VALUES
for pages 12 and 13

United States Naval Observatory Circular No. 122

Annular Eclipse of 18 March 1969

Sydney, Australia

First Contact
Universal
Time P V
h m s ° °
4 45 03.2 299 164

Maximum Eclipse
Universal Magni- Sun's
Time tude Alt. Az.
h m s ° °
5 14 27.7 0.067 35 296

Fourth Contact
Universal
Time P V
h m s ° °
5 43 07.6 343 214

This Circular contains positions of the sun, moon, and planets observed with the Six-Inch Transit Circle between 12 July, 1967 and 23 June, 1968. These results are provisional. Definitive results will be published in a volume of Publications of the U. S. Naval Observatory.

These results are a continuation of those published in U. S. Naval Observatory Circular No. 118.

The observed positions are geocentric and have undergone the usual corrections for instrumental errors, refraction, annual aberration, parallax, and orbital motion. The right ascensions were reduced, chronologically, to the FK4 system by means of the FK4 stars used in determining the clock correction.

The declinations of the night objects have been reduced to the FK4 system by applying a correction derived from the same stars that were used for the clock correction.

The sun, Mercury, and Venus were reduced with the clock correction of the nearest night hour and the sidereal time at the time of the observation. Corrections for the other night differences are not available at this time.

Observations of Mercury and Venus were made on the illuminated disk or on the center of light as indicated, and reduced with the appropriate corrections to the center of the planet. Observations of the sun, Mars, Jupiter, and Saturn were made on both disks of light. Those of Mars and Jupiter have been corrected by geometric illumination. The tabular semidiameters from the Ephemeris have been used whenever a correction from light to center or a correction for defective illumination has been applied. The moon observations were made on the illuminated disk as